2010 2015 2020 2025 2030

CLIMATE CHANGE SOLUTIONS FOR AUSTRALIA 2008

THE AUSTRALIAN CLIMATE GROUP

	2010	2015	2020	2025

WWF-Australia

Head Office
GPO Box 528
Sydney, NSW, Australia 2001
Tel: +612 9281 5515
Fax: +612 9281 1060
wwf.org.au

ISBN: 1921031 26 3

Cover image: © Mark Snelson, www.marksnelson.com.au

Design: Three Blocks Left

This report is printed on 9lives 80, 80% post-consumer recycled fibre and 20% Virgin FSC Certified Mixed source fibre.

World Wide Fund for Nature ABN: 57 001 594 074

CONTENTS

2010 2015 2020 2025

EXECUTIVE SUMMARY

- An overwhelming body of scientific evidence now clearly shows that the Earth is warming; this warming has already impacted on biological and physical systems around the world and here in Australia; global warming since around 1950 has resulted largely from human-caused emissions of greenhouse gases, and; on-going growth of these emissions will deliver far greater impacts on the environment and our economy as we progress into this century.
- There is increasing evidence that catastrophic climate change is a possibility and, if this occurs, it is highly likely that Australia (and the Asia-Pacific region generally) will be severely affected within our lifetime.
- There is now compelling evidence that both the extent and the impacts of climate change are likely to be at the higher end of the range projected by the Intergovernmental Panel on Climate Change (IPCC).
- Australian policy needs to take account of this possibility by designing a national emission reduction scheme that is flexible enough to respond to new information quickly.
- The Intergovernmental Panel on Climate Change has found that global emissions of greenhouse gases would have to peak by 2015 and fall by 50% to 85% by 2050 to limit global temperature rise to 2.0 to 2.4 Celsius over pre-industrial times. This rise is likely to avoid many of the worst impacts of climate change but will not be without very significant consequences.
- Accordingly, we need to take account of this by stabilising emissions in the near term and establishing a clear emissions reduction target for 2020 so that short-and medium-term reductions will be achieved. This will also avoid the risk that emitters will "game" the system (by failing to make reductions and then defaulting or seeking government assistance when unable to do so).
- Australia must seek a global agreement to reduce greenhouse gas emissions. This will only happen if Australia and other developed countries commit to significantly reducing their own national emissions. Early, substantial global reductions will avoid larger long-term economic costs and reduce the risk of triggering significant impacts from climate change.
- The Rudd Government's climate policy has been very progressive: ratification of the Kyoto Protocol; a 20% renewable energy target by 2020; a renewable energy fund; a low emission coal fund; an emission trading scheme by 2010; a long-term national emission reduction target; a commitment to develop a clear 2020 emission reduction target; measures to improve energy efficiency, and the progressive stance adopted by the Government at the United Nations Framework Convention on Climate Change Conference/Meeting of the Parties at Bali and particularly its strong support for a collective emissions reduction target for developed countries of 25%- 40% below 1990 levels.
- The only major outstanding commitments for the Government are to stabilise and reduce emissions in the short-term; actions that will signal to the Australian community and the rest of the world that Australia is committed to tackling "dangerous" climate change.

KEY MESSAGES:

The Australian Climate Group recommends that the Rudd Government adopt measures to:

▶ **Stabilise national emissions by 2010 through both domestic measures and the purchase of international emissions reduction permits;**

▶ **Establish an emissions target for 2020 consistent with that of other developed countries (such as the European Union);**

▶ **Ensure that the emission trading scheme is designed such that the Australian Government is not burdened by failure of participants to comply with it;**

▶ **Ensure that the national emission trading scheme is flexible enough to respond to new information quickly.**

CATASTROPHIC CLIMATE CHANGE

If global emissions continue to rise at the current rate, we dramatically increase the risk of triggering exponential and irreversible large-scale events ("tipping points") such as:

- Turning oceans from "sinks" that absorb around half the carbon dioxide entering the atmosphere into carbon dioxide "sources" that release the stored carbon dioxide and exacerbate the rate of global warming;
- Releasing large quantities of stored greenhouse gases from thawing permafrost which will lead to further increases in temperature; and
- Disintegration of the Greenland and West Antarctica ice sheets raising sea levels and decreasing the amount of solar energy being reflected back into the atmosphere (which would further accelerate global warming).

While these are unknown probability or low-probability events, prudent policy needs to be precautionary given the uncertainty of the exact temperature trigger and the scale and long-lasting nature of these impacts.

CLIMATE CHANGE IN AUSTRALIA

The most recent science indicates a large range of impacts including:

- Much of Australia faces significant temperature increases, particularly inland but also in coastal areas;
- An increased risk of long-term drying and drought projected over most of Australia by 2030;
- More severe hailstorms and cyclones as well as a shift into previously unaffected areas;
- Rapid loss of the key Australian ecosystems such as: the Wet Tropics (through drying), Kakadu (through saltwater inundation) and the Great Barrier Reef (through more severe coral bleaching and mortality events, and ocean acidification); and
- Greater risk of severe heatwaves south of the tropics, and expansion of the transmissibility zone for some infectious diseases like dengue fever.

ADAPTATION TO CLIMATE CHANGE IN AUSTRALIA

- Although this report does not address adaptation to climate change, some temperature increase is already a certainty. The Australian Climate Group recognises that Australia must implement adaptive management strategies and capacity building to increase the resilience of both human and natural systems to changes in climate conditions.
- Adaptation will be necessary across all sectors. For example, in relation to biodiversity conservation there are many constraints on natural adaptation. Landscapes are dominated by humans, natural habitats are highly fragmented, and stresses such as altered fire regimes, invasive species, and water and resource extraction threaten ecosystem health and biodiversity. Both adaptation and mitigation are therefore essential to safeguard Australia's biodiversity from climate change.
- Similarly in other sectors, there are many examples of adaptation needs including in relation to agricultural practices, water conservation, urban planning, coastal management, public health surveillance and control measures, early-warning systems for extreme events and conditions, and enhanced rural community resilience.
- Adaptation of our built environment will be needed to help communities withstand the impact of more severe weather events, hotter temperatures and higher sea levels. The location of our coastal buildings, the construction standards and materials we use, and our emergency management capacity are just some examples of the areas where we are likely to require adaptation to climate change.

2010 2015 2020 2025

THE AUSTRALIAN CLIMATE GROUP

The Australian Climate Group was formed in late 2003 by WWF-Australia and Insurance Australia Group (IAG) in response to the increasing need for action on climate change in Australia. The Australian Climate Group is:

Professor Ove Hoegh-Guldberg
University of Queensland

Professor David Karoly
University of Melbourne

Professor Ian Lowe
Griffith University

Professor Tony McMichael
Australian National University

Dr Graeme Pearman
Monash University

Tony Coleman
Chief Risk Officer & Group Actuary – Insurance Australia Group

Greg Bourne
CEO WWF-Australia

2030 2035 2040 2045 2050

GOVERNMENT POLICY NEEDS TO BE FLEXIBLE BECAUSE IMPACTS MAY ARRIVE SOONER AND BE MORE SEVERE THAN PROJECTED

THE IMPACTS OF CLIMATE CHANGE ARE LIKELY TO BE AT THE HIGHER END OF THE RANGE

The Australian Climate Group believes there is now compelling evidence that both the extent and the impacts of climate change are likely to be at the higher end of the range projected by the Intergovernmental Panel on Climate Change (IPCC).

Furthermore, the Intergovernmental Panel on Climate Change reporting does not fully reflect the possibility of relatively abrupt and more rapid changes that could occur if components of the climate system exceed critical thresholds heralding high-impact irreversible events (like rapid de-glaciation, slowing of ocean currents, and release of previously stored gases in permafrost and the ocean depths). It does not fully consider these unknown or low-probability but high-impact events because current knowledge limits our ability to reliably assess their probability of occurring.

In addition, the length of time involved in developing a consensus approach means new observations and relevant information cannot be easily considered. For example, a study in 2007 indicated that the probability of serious impacts from several high-impact events increases where global mean temperatures warm by more than around 1.6ºC above pre-industrial levels. This research is not currently reflected in the latest Intergovernmental Panel on Climate Change findings, which used material published up to mid-2006, suggesting the Intergovernmental Panel on Climate Change report may be under-estimating the risks and/or speed of the risks occurring given observed impacts.

Responsible policy should consider these thresholds and their impacts, which though remote, are too significant to ignore. The possibility of exceeding them is real with any further increase in global temperature bringing them a step closer and more probable. Considering the impact of exceeding these critical thresholds is likely to be exponential rather than linear, the Australian Climate Group suggests it is prudent to reduce the risk of these irreversible events occurring through adopting a precautionary and least risk approach to policy making. There is no other way by which to chart a responsible policy pathway.

More information on these unknown or low-probability but high-impact events is provided on pages 6-7.

"Since the Australian Climate Group's first report my concern has grown rapidly as new evidence has emerged. It appears to me that there is a major disconnect between the scientific evidence and wider community perception as to what we are risking. Further, the time period between now and when the risk of massive national and global impacts can be avoided is rapidly closing. This raises serious questions about the capacity of existing governance systems to engage with independent expert advice and to act strategically in the wider and global interests against narrow sectoral and sovereign interests." ***– Graeme Pearman***

2010 | 2015 | 2020 | 2025 | 2030

"I have been following the science of climate change for nearly 30 years. The effects that were being predicted for the 2020s are being seen already. So there is an urgent need for concerted action. All the work we are doing on other environmental problems will be irrelevant if we don't slow down climate change." ***– Ian Lowe***

ARCTIC SEA ICE IS MELTING FASTER THAN ANTICIPATED

Arctic sea ice performs an important role as a polar cooling mechanism. It helps control the Earth's temperature by reflecting sunlight back into the atmosphere. Less ice means more solar energy is absorbed by our oceans which leads to greater warming, which in turn melts more ice, and so on. This is an example of the all-important "positive feedback" mechanisms that are inherent to many processes operating with climate change.

The amount of Arctic sea ice melting in summer has dramatically increased. The previously lowest extent of sea ice – 5.32 million square kilometres – recorded in September 2005, was surpassed in September 2007, when the ice measured 4.13 million square kilometres. The Intergovernmental Panel on Climate Change projected the probable complete melting of summer Arctic sea ice by 2050. Recent observations suggest this may occur by 2030. The impact must be factored into climate change modelling and policy-making.

Figure 1: Sea ice extent for September 16, 2007

Source: National Snow and Ice Data Centre

The magenta line in Figure 1 shows the median September extent, based on 1979–2000 data and the white area show the sea ice extent on 16 September 2007.

POTENTIAL RAPID MELTING OF ICE SHEETS

Perhaps the most well articulated critical threshold ("tipping point") is the possibility of rapid de-glaciation of Greenland and parts of Antarctica. The Intergovernmental Panel on Climate Change Fourth Assessment Report's (2007) projected sea-level rise throughout this century of up to 60 centimetres does not take into account rapid de-glaciation because our current understanding of the processes governing ice sheet stability is too rudimentary to make projections. However, rapid de-glaciation would have significant consequences for sea-level rise. There is overwhelming evidence that the Greenland ice sheet is already contracting. If it were to melt or disintegrate completely, sea levels could rise by around 7 metres globally.

2035	2040	2045	2050

SIGNIFICANT SLOWING OF OCEAN CURRENTS

Ocean currents transport heat around the planet. Many of these currents are driven by the heat differential between equatorial and polar regions. In the polar regions, warm saline water originating from the lower (equatorial) latitudes is cooled. Cooling increases water density, causing waters to sink as they progress through the high latitude seas. This sinking of water at the poles powers a "conveyor belt" that drives deep waters towards the equator while at the same time driving surface water of the thermohaline circulation poleward. The thermohaline current is one of the major forces determining the direction and speed of the Earth's currents. As ocean currents determine the patterns of marine productivity and climate, changes to thermohaline circulation are likely to have major effects on natural ecosystems as well as aspects of terrestrial climates, such as rainfall. Evidence suggests that currents associated with thermohaline circulation are already slowing.

Another key large-scale irreversible impact relating to oceans is that if global emissions continue to rise at the current rate, we dramatically increase the risk of turning oceans from "sinks" that absorb around half the carbon dioxide entering the atmosphere into carbon dioxide "sources" that release the stored carbon dioxide and exacerbate the rate of global warming.

RAPID RELEASE OF STORED GREENHOUSE GASES

Greenhouse gases such as carbon dioxide and methane are currently trapped in permanently frozen ground known as permafrost. There is clear evidence that some of this ground is thawing and that thawing is expected to increase. The Intergovernmental Panel on Climate Change's Fourth Assessment Report (2007) observed that temperatures in the Arctic at the top of the permafrost layer have generally increased (by up to 3ºC) since the 1980s.

Thawing of permafrost causes two problems:

- melted areas do not reflect as much sunlight back into the atmosphere; and
- permafrost represents a huge store of frozen plant biomass, which will drive a major increase in microbial activity once it has thawed. This in turn leads to the enormous increase in the production of methane and carbon dioxide, both of which will lead to further increases in temperature.

If gases were released rapidly over a great area, driving further thawing and greenhouse gas production, projections of future global warming would have to be substantially revised upwards.

THE RISK OF DANGEROUS AND COSTLY CLIMATE CHANGE IMPACTS HAS

Our understanding of the rate of climate change and its current and future impacts has improved greatly since the Australian Climate Group's 2004 report. Recent observations of carbon dioxide concentrations, global mean temperatures, and sea-level rises show that increases are at the upper end of the Intergovernmental Panel on Climate Change's projected ranges since 1990 and are occurring earlier than projected.

Climate change will be experienced differently throughout the world but Australia's arid landscape and largely coastal population concentration makes us particularly vulnerable. The following section provides a summary of current scientific thinking around key climate issues.

TEMPERATURE

Average Australian temperatures have risen around 0.9ºC since 1950. While the average temperature increase in Australia is expected to be close to the global average warming, the inland temperature increase is typically 30 – 50% higher than the global average and often 50% higher than along our coasts.

Emissions scenarios provide a range of likely temperature increases on 1990 temperatures of 1.1ºC – 6.4ºC by 2100. In Figure 2, based on a moderate future growth of greenhouse gas emissions, Intergovernmental Panel on Climate Change Scenario B1 shows this temperature increase is lower if emissions are reduced. By 2070 this results in around a 1ºC – 2.5ºC increase in temperature (on 1990 levels) depending on location in Australia.

However, the world's dependence on fossil fuels means we are on a high emissions trajectory (like the A1FI scenario) and current observed emissions are near the higher emissions trajectory. Modelling links this pathway to a much higher temperature increase range of 2.5ºC - 4ºC by 2070. The actual global emissions growth rate since 2000 exceeds this high emissions pathway.

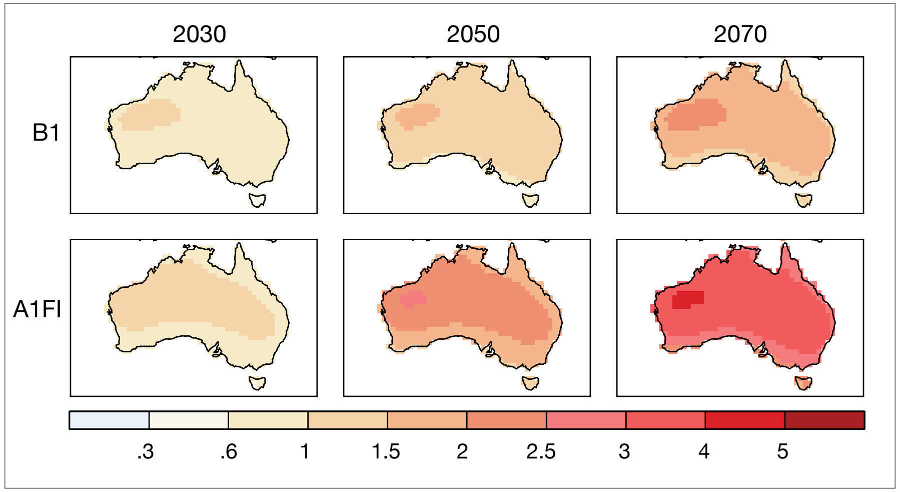
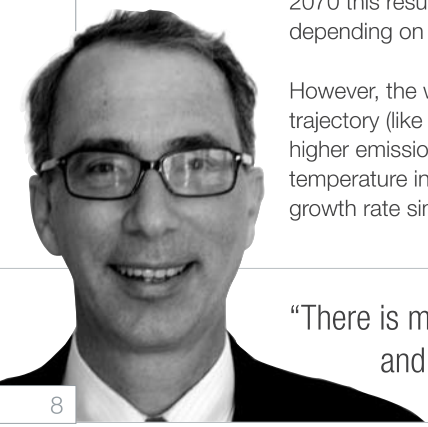


Figure 2: Shows the best estimates (50th percentiles) of projected changes in annual mean temperatures (degrees Celsius) for 2030 (left), 2050 (middle) and 2070 (right) for the two Intergovernmental Panel on Climate Change emissions growth scenarios, B1 (moderate) and A1F1 (high)

Source: CSIRO and BoM, Climate Change in Australia – Technical Report 2007



"There is much more evidence that the rate of climate change is at the upper end of past projections and that some impacts are worse than predicted." ***– David Karoly***

RISEN SIGNIFICANTLY

If global emissions continue to rise at the current rate (the Intergovernmental Panel on Climate Change A1F1 scenario), modelling suggests the following increase (Figure 3) in the average number of days above 35ºC in Australia.

City	Current average	Average in 2070
Sydney	3.5	8
Melbourne	9	20
Adelaide	17	36
Brisbane	1	7.6
Hobart	1.4	2.4
Perth	28	54
Darwin	11	227

Figure 3: Shows the best estimates (50th percentiles) of projected average number of days above 35ºC in Australia

Source: CSIRO and BoM, Climate Change in Australia – Technical Report 2007

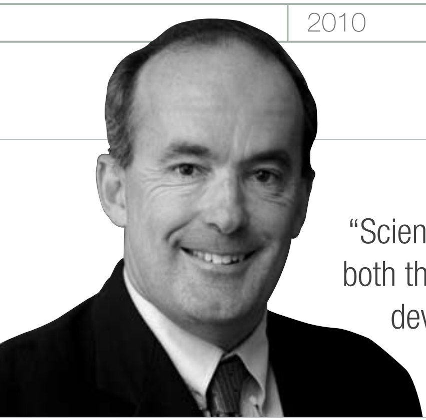
WATER AND DROUGHT

Rainfall disruptions are difficult to assess because large variations between years and decades can hide long-term trends. However, since 1950 more rain has fallen in north-western Australia, less rain in southern and eastern Australia, and droughts have increased in intensity.

In future, average rainfall is predicted to decline across Australia, but not in a uniform manner. Some areas – such as northern New South Wales, central Northern Territory and Tasmania – are likely to experience higher rainfall. Less rain is predicted for most of southern and sub-tropical Australia. Seasonal rainfall is also projected to change with forecasts of more rain in northern Australia during the wet season and less rain in southern Australia, particularly in winter, associated with a southward shift in storms. Extreme rainfall is also expected to change with increases heavy and very heavy rain, and increases in the number of consecutive dry days.

A marked increase in the frequency of droughts is also likely with up to 20% more droughts predicted over most of Australia by 2030. By 2070 this increases to up to 40% in eastern Australia and 80% in south-western Australia.

Warmer temperatures are also likely to mean faster evaporation. Together with less rain, this is likely to lead to marked reductions in soil moisture and stream flow throughout much of Australia, particularly in the south and east. Water security problems are projected to intensify by 2030 in southern and eastern Australia. The Murray-Darling Basin, which accounts for around 70% of our irrigated crops and pastures, can expect a decrease in annual stream flow of 10–25% by 2050. By 2020, there is a 50% chance that the average salinity of the lower Murray River will exceed the threshold for drinking and irrigation.



"Science is an inherently conservative process, and hence, is likely to seriously underestimate both the rate and nature of the challenges ahead. We need to be mindful of this when we develop policy responses to climate change." ***– Ove Hoegh-Guldberg***

OCEANS

SEA-LEVEL RISE

Higher temperatures and commensurate sea-level rises will dramatically increase the vulnerability of coastal populations and infrastructure to inundation, coastal erosion and storm surges, particularly in the face of increased storm intensity.

The rate of observed global sea-level rise since 1990 is at the upper limit of projections in the Intergovernmental Panel on Climate Change's Third Assessment Report (2001). Over 60% of Australians live within 100 kilometres of the coast. Homes, businesses, air and sea ports, transport routes, urban infrastructure and natural ecosystems (such as beaches, wetlands, coastal forests and mangroves) are often within a few metres of the sea. Globally, the sea is rising at an average of 1.8 millimetres per year as a result of both the expansion of ocean waters as they warm and the accelerated melting of glaciers and ice sheets. Current evidence indicates that the rate of sea-level rise is increasing. Estimates suggest a rise of 18–59 centimetres by 2100 and the possibly of up to 20 centimetres more contributed by ice sheet melting. Reaching tipping points, such as disintegration of the Greenland and West Antarctic ice sheets, would add more than 5–8 metres to sea-level rise calculations.

ACIDIFICATION

Oceans act as a giant carbon sink, absorbing almost half the carbon dioxide entering the atmosphere. When carbon dioxide interacts with water it produces an acid (carbonic acid). This acid decreases the concentration of carbonate ions, which are all-important to marine calcifiers such as the corals that build the Great Barrier Reef. There is now evidence that rising atmospheric carbon dioxide concentrations have acidified the oceans by about 0.1 pH. Further acidification is likely to put most marine ecosystems under substantial pressure and potentially place entire ocean food webs at risk. The rapid acidification of the Southern Ocean, for example, is starting to threaten primary productivity and may have far-reaching consequences for dependent organisms, including several key Australian fishery species.

Higher temperatures, fuelled by increased atmospheric concentrations of carbon dioxide, will increase the rate of acidification and therefore substantially impact on the ability of oceans to absorb carbon dioxide in the future. New evidence suggests that carbonate reef systems like the Great Barrier Reef cannot exist at carbon dioxide concentrations of more than 450 parts per million ("ppm").

DAMAGE TO NATURAL AUSTRALIA

Rapid changes to temperature, water availability and regional climates is already impacting on Australia's ecosystems, putting our unique biodiversity at risk. The Intergovernmental Panel on Climate Change's Fourth Assessment Report (2007) identified six key Australian "vulnerability hot spots": the Murray-Darling Basin, Wet Tropics (including the Great Barrier Reef), Kakadu, South-Western Australia, south-eastern Queensland and our alpine regions. A temperature rise above 2ºC not only risks irreversible damage to natural Australia, but also significant economic losses.

CORAL REEFS

Ocean acidification and a 2ºC sea temperature rise pose significant threats to coral reefs. Acidification could cause reefs such as the Great Barrier Reef (GBR) and those off Western Australia to start eroding, with huge ramifications for those ecosystems and their economies. Around 1.6 million tourists visit the GBR annually and associated tourism is a significant employer and economic mainstay. In 2004–05 the GBR generated over US$4.48 billion and provided the equivalent of around 63,000 full-time positions.

A 2ºC rise in sea temperatures (plus the acidification associated with atmospheric CO_2 of 450ppm) will all but eliminate reef-building corals such as those found within the GBR, which are home to an estimated one million species that live in and around coral reefs. A recent study has shown that the area of coral in the Pacific region (including the GBR) is currently declining at the rate of 1- 2% a year. While a range of factors including declining water quality and over-exploitation of key fish species have contributed to this decline, the growing periods of heat stress is a major factor.

Higher sea temperatures are also likely to lead to more frequent and more intense bleaching events. Mass bleaching events were not recorded in the GBR before 1979, but since then there have been at least seven major events (in 1982, 1987, 1992, 1994, 1998, 2002, and 2006) and bleaching is likely to impact on the reef's appeal as a tourist destination.

POTENTIAL HEALTH IMPACTS

Climate change will have many effects on population health in Australia, mostly adverse. Extreme weather events (such as floods, bushfires, and cyclones) will cause injuries and deaths, and will endanger livelihoods and mental health. Heatwaves are a particular hazard, especially in heat-retaining urban environments. Future increases in their frequency and intensity will cause more deaths and serious illness events, particularly in older persons and those with pre-existing chronic diseases. Modelling studies project a two to three-fold increase in urban heat-related death rates by around mid-century.

The impact of climate change on rural Australia, with long-term drying likely in some regions, will threaten livelihoods, community cohesion and mental health. Greater exposure to heat, dust, and smoke in the rural environment will pose health risks, and drying and freshwater shortage may endanger local food yields and domestic hygiene.

Many infectious diseases are sensitive to climate conditions. Bacterial food poisoning rates increase with warmer temperatures. Diseases spread by mosquitoes and other vectors tend to spread more widely with increases in temperatures, rainfall and humidity – and some, such as mosquito-borne dengue fever, are anticipated to spread further south into sub-tropical Australia.

CLIMATE CHANGE, EXTREME WEATHER EVENTS AND INSURANCE

Severe weather events are economically costly, emotionally devastating and potentially life-threatening. Nineteen of Australia's twenty most costly natural disasters have been caused by severe weather, including eight hailstorms and five tropical cyclones (Figure 4). Under climate change, Australians are likely to experience an increase in intense cyclones and intense hailstorms affecting some of our most heavily populated regions.

TROPICAL CYCLONES IN SOUTH-EASTERN QUEENSLAND AND NORTHERN NEW SOUTH WALES

Climate change is expected to cause tropical cyclones to become more intense and possibly to move south over the heavily populated areas of south-eastern Queensland and northern NSW. However, this trend could remain hidden for several decades, masked by high natural variations in the number of cyclones from decade to decade.

During the next 50 years there is potential for tropical cyclones that are more intense than have ever been recorded in the South-West Pacific Basin. This significantly higher cyclone risk would have serious consequences for communities and infrastructure in heavily populated coastal regions unprepared for the damaging winds, flooding and destructive storm surges.

"As climate change advances we must realise that it endangers more than the economy, infrastructure and valued species. Climate change, ominously, is disrupting and weakening Earth's life-supporting capacity. This poses a profound, and growing, risk to human wellbeing, health and survival." ***– Tony McMichael***

SYDNEY HAILSTORMS

Climate change is expected to affect several factors that drive hailstorm intensity in the Sydney Basin, such as sea surface temperatures and air currents. Some scientific research suggests that hailstorms with hail 9 centimetres in diameter could become twice as frequent between 2000 and 2050. Sydney has already experienced hailstones 9 centimetres in diameter during the April 1999 hailstorm, which is the most costly natural disaster in Australia's history with losses in excess of $2.35 billion (CPI-indexed to 2007 dollars).

OUR COMMUNITY'S ABILITY TO POOL RISK

Accessible and affordable insurance that spreads weather-related risk is an important component of the national economy. If the insurance industry's ability to underwrite weather-related risk was reduced or the cost of insurance rose significantly, it could have serious implications for the economic health of vulnerable regions.

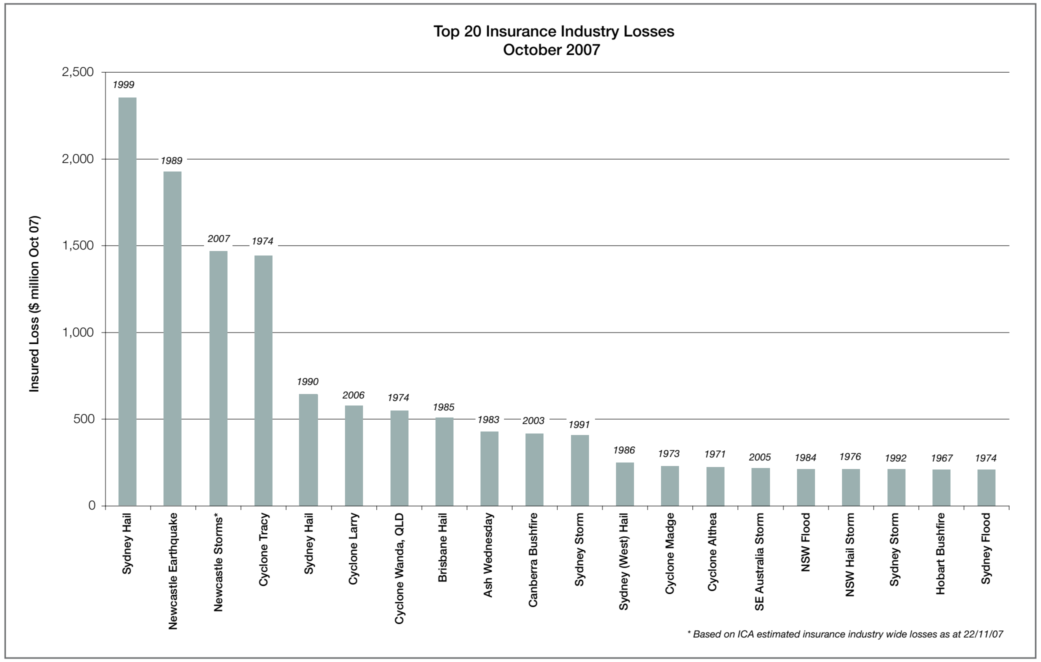


Figure 4: Australia's 20 most costly natural disasters

Source: Insurance Australia Group, based on data collected by the Insurance Council of Australia

"Insurers are familiar with managing risks to our community that are often quite uncertain and sometimes potentially catastrophic. Yet Australia is tolerating a level of climate change risk that would be unthinkable if the nation were held to the same standards that we apply to safeguard the survival of the insurers, banks and superannuation funds that we all depend upon in our daily lives. The Australian Prudential Regulatory Authority requires all licensed Australian insurers to be managed so as to be able to withstand combinations of events expected to occur only once in every 200 years. These levels of risk – 0.5% p.a. or less – are completely dwarfed by the risk levels to our way of life that are now reliably attributable to potentially catastrophic climate change impacts, unless we act with urgency to rapidly reduce greenhouse gas emissions." ***– Tony Coleman***

IMMEDIATE GOVERNMENT ACTION IS NEEDED

Avoiding dangerous climate change is achievable. However, we have only a small and rapidly closing window of opportunity within which to act. Commitment to decisive government policy and action is needed now to avert dangerous impacts and to minimise the cost of decarbonising Australia's economy. The economic consequences, alone, of failing to reduce emissions rapidly and sufficiently are immense and Australia could be particularly vulnerable in the event of a sudden shift in global attitudes to greenhouse gas emissions due to our heavy dependence on coal as a primary energy resource and export commodity. The threat posed by climate change is now too great to ignore.

The Australian Climate Group is concerned that Australia's emissions continue to rise and will soar further if we do not take immediate action. Current Australian Greenhouse Office projections for Australia (Figure 5) show our emissions rising steeply for 1990–2020.

"We must shift in the way we go about our business. We must deliberately build resilience in our environment, build resilience in our society and start a revolution in our economy.

The responsibility that befalls our generation; the card that has been dealt to us, is to turn the corner; to move away from an ethos that has seen us mine the planet to pay for the present, and towards an ethos that focusses on securing a sustainable future." ***– Greg Bourne***

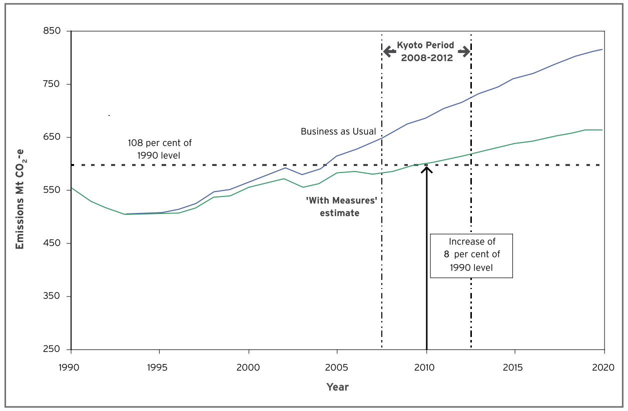


Figure 5: Australia's Greenhouse Gas Emissions Trends

Source: Department of Climate Change, 2007 Tracking the Kyoto Target.

From 1990 to 2010 Australia's greenhouse gas emissions are predicted to grow by around 8%. They have largely been kept at that level through one-off savings from reductions in land clearing. It is disturbing that emissions are projected to reach 120% of the 1990 level by 2020, even with current reduction measures. Australia's emissions are therefore headed in the wrong direction. We urgently need a target for emissions to peak and then decline rapidly.

A 2010 emissions peak is feasible. It would assist in ensuring that the economic impacts of climate change are minimised and send a clear signal that government is committed to tackling climate change.

A 2020 milestone serves two important functions:

- it ensures that Australia is on an appropriate emissions reduction trajectory for 2050; and
- it places us in a position to make deeper cuts if, as scientific evidence firms, impacts continue to occur at the upper end of projections and faster than anticipated.

Australia needs to adopt targets that are based on science and also position the nation on an emissions reduction trajectory that accords with the minimum international obligations likely to be placed on our nation in the future.

The Australian Climate Group recommends that the Rudd Government adopt measures to:

- Stabilise national emissions by 2010 through domestic measures and the purchase of international emissions reduction permits;
- Establish an emissions target for 2020 consistent with that of other developed countries (such as the European Union);
- Ensure that the emission trading scheme is designed such that the Australian Government is not burdened by failure of participants to comply with it;
- Ensure that the national emissions reduction scheme is flexible enough to respond to new information quickly.

These measures may be considered challenging but need to be viewed in the context of the world's historical experience of pollution abatement programs. The cost of pollution abatement has often been significantly over-estimated prior to commencement of measures. Once the actual cost has emerged, the initial cost estimates have been revised downwards, sometimes by as much or more than 1,000%.

There is widespread recognition that an average global emissions reduction of 50% is needed by 2050, suggesting that developed countries like Australia will need to reduce their emissions by 60–90% (on 1990 levels) by 2050. In the international context, Australia's ability to negotiate its own targets may be limited and future targets may not be nearly as favourable as the 108% allowed under the Kyoto Protocol for the period up to 2012.

We believe it is prudent to assume that Australia will be asked to take on a share of reductions proportional to our historical responsibility for emissions, our status as a wealthy developed nation and our access to abundant low-emission sources of energy. It is probable that Australia will be asked by the international community to reduce its emissions by at least 60% (on 1990 levels) by 2050. We need to take a responsible risk-management approach and prepare for the deep cuts required of a future decarbonised world economy.

A balanced risk-management approach also requires that we consider the potential for serious economic disruption elsewhere to impact heavily on Australia. Countries in our region may lack the economic capacity or ability to adapt to impacts of climate change (such as inundation or increased tropical storms) and Australia faces the prospect of entreaties from environmental refugees. A downturn in Asia's economic growth as a result of climate change has the potential to seriously affect markets for our export products.

POLICY SOLUTIONS

A range of complementary government policies, implemented early to halt emissions increases and improve investment certainty, are required to achieve emissions reduction targets. Policy success will be gauged by actual reductions in greenhouse gas emissions.

Four key policy measures will contribute to achieving emissions reduction targets:

- establishing a realistic carbon price signal through an emissions trading scheme;
- encouraging investment in energy efficiency;
- encouraging investment in the development and use of low-emission and renewable technology; and
- halting and reversing land clearance and forest degradation.

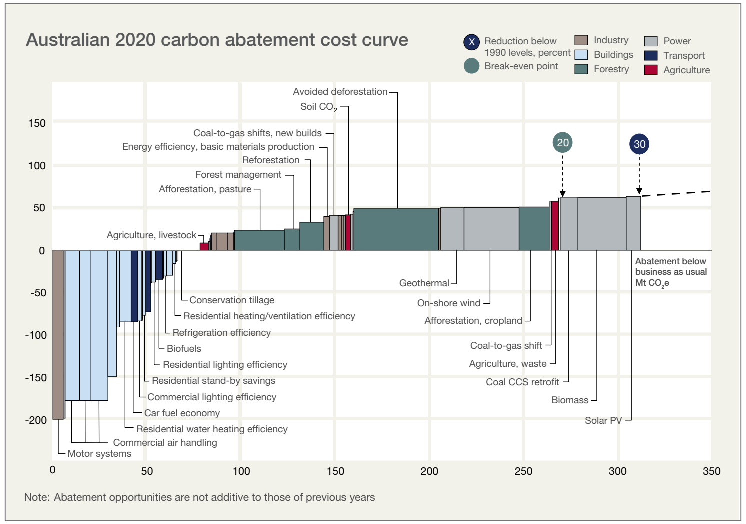


Figure 6: Australian 2020 Carbon Abatement Cost Curve

Source: McKinsey & Company, An Australian Cost Curve for Greenhouse Gas Reduction (2008)

ESTABLISHING A PRICE SIGNAL FOR CARBON

Australia needs to put a price on carbon through the introduction of an emissions trading scheme. The key features of a successful scheme include:

- a long-term, scientifically-based emissions reduction target with which the short term caps are consistent;
- an early commencement date to give investors greater certainty in making their infrastructure and investment decisions;
- broad coverage of all measurable sources of emissions (including stationary energy, transport, major industrial infrastructure and fugitive emissions) so as to be most effective and economically efficient, and distribute the costs most equitably;
- flexibility to tighten targets (as the scheme's performance or climate science dictates); and
- auctioning of permits, with a strict limit on the number of permits given away. This will allow market forces to set the price, and provide revenue to support research, development and the commercialisation of low-emissions technologies, and build the nation's resilience to the climate change that is already locked in. It will also provide revenue for measures to minimise the scheme's impact (i.e. on low income families, highly vulnerable regions, as well as to trade-exposed energy-intensive industries until international competitors face similar carbon constraints).

INVESTMENT IN ENERGY EFFICIENCY MEASURES

The rate of improvement in energy efficiency worldwide from 1990–2004 dramatically slowed after gains in previous decades. Australia, like many nations, has significant untapped potential to make the most of energy efficiency opportunities. Investing in energy efficiency is a cost-effective way of rapidly reducing Australia's emissions.

McKinsey's Australian 2020 Carbon Abatement Cost Curve (Figure 6) illustrates that energy efficiency is not only by far the most cost-effective way to reduce emissions, but that it is also overwhelmingly associated with positive returns to the economy.

Energy efficiency can best be encouraged through setting an energy efficiency target and supporting policy structure that encourages the adoption of best practice standards. As best practice continues to develop, two-yearly reviews of the standards would drive rapid uptake of improvements to:

- a uniform national building code;
- vehicle emission standards and a registration system favouring more fuel-efficient vehicles;
- the efficiency of appliances and equipment; and
- industrial plant standards.

Consumer awareness programmes, like an easily recognisable star rating and energy labelling scheme for all appliances, help consumers to make informed decisions. In the case of building standards, a requirement for all buildings (residential and commercial) to disclose their energy rating at point of sale or lease would benefit consumers.

LOW-EMISSION AND RENEWABLE TECHNOLOGY

Technological developments are needed to help Australia adapt to a future carbon-constrained world. Currently around 35% of Australia's emissions come from electricity generation and coal accounts for approximately 76% of electricity generation. Just 8% of electricity generation comes from renewable sources, with hydro accounting for almost all of this.

Technological advances can help reduce Australia's energy emissions by supporting development of a robust renewable energy sector, and by capturing and storing carbon emissions (i.e. from coal-fired electricity generation plants).

Given our abundant renewable energy sources such as bioenergy, sun and wind, Australia would be wise to encourage their use and development. Longer-term research and development investment is also needed in renewable energy sources such as geothermal energy as a base load electricity supply. This would have flow-on benefits by not only insulating Australia from future global carbon constraints, but also promoting local business and employment.

There is currently no operational carbon capture and storage coal-fired power station either here or overseas to prove that the technology is feasible. However, if carbon capture and storage becomes possible, coal could play an important role in Australia's future energy generation.

STOP NET LAND CLEARANCE

The annual rate of land clearance has more than halved since 1990, largely due to State legislative controls, but it still accounts for around 6-10% of Australia's emissions.

Clearing land has a twofold impact on emissions:

- it releases stored carbon into the atmosphere; and
- removes carbon sinks capable of absorbing CO_2.

The Australian Climate Group recommends that any future land clearing be accompanied by tree planting to ensure no net emissions.

CONCLUSION

If we are to avoid the most severe social, economic and environmental impacts of climate change, the Australian government needs to take action quickly. This action must be sufficiently flexible to allow policies and targets to be adjusted should impacts and projections worsen. The Australian Climate Group urges the Australian government to implement policies that will stabilise emissions by 2010 and reduce emissions in the short term.

BACKGROUND INFORMATION ON THE AUSTRALIAN CLIMATE GROUP

Professor Ove Hoegh-Guldberg
University of Queensland

Ove Hoegh-Guldberg is Professor at the University of Queensland where he heads the Centre for Marine Studies and is responsible for three of Australia's marine research stations on the Great Barrier Reef. He is a member of the Royal Society of London working on Ocean Acidification and chairs the World Bank-IOC_UNESCO Targeted Working Group on coral bleaching and climate change. He also runs a large research laboratory and has produced over 120 peer reviewed scientific articles on the ecology of coral reefs. He was awarded the Eureka prize for scientific research in 1999 for his contribution to understanding the impacts of climate change on coral reef ecosystems.

Professor David Karoly
University of Melbourne

David Karoly returned to Australia in May 2007 as an ARC Federation Fellow and Professor in the School of Earth Sciences at the University of Melbourne. Previously, he was the Williams Chair Professor of Meteorology at the University of Oklahoma from 2003-2007, Head of the School of Mathematical Sciences at Monash University from 2001-2002, and Professor of Meteorology and Director of the Cooperative Research Centre for Southern Hemisphere Meteorology at Monash University during 1995-2000. David was heavily involved in the preparation of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change released in 2007, as a lead author in one chapter, a review editor of another chapter, and as a member of the Core Writing Team of the Synthesis Report. For his work in the preparation of the Intergovernmental Panel on Climate Change Assessments in 2001 and 2007, he shared in the Nobel Peace Prize awarded in 2007 jointly to the Intergovernmental Panel on Climate Change and Al Gore.

Professor Ian Lowe
Griffith University

Ian Lowe is an Emeritus Professor at Griffith University in Brisbane, where he was previously Head of the School of Science. He directed the Commission for the Future in 1988 and chaired the advisory council that produced Australia's first national report on the state of the environment in 1996. In 2000 he received the Queensland Premier's Millennium Award for Excellence in Science and the Prime Minister's Environmental Award for Outstanding Individual Achievement. In 2001 he was made an Officer of the Order of Australia. He wrote a weekly column for *New Scientist* for 13 years and received the 2005 Eureka Award for Promotion of Science. He is President of the Australian Conservation Foundation.

Professor Tony McMichael
Australian National University

Tony McMichael is a National Health and Medical Research Council (NHRMC) Australia Fellow at the National Centre for Epidemiology and Population Health, at the Australian National University, Canberra. During 1994-2001 he was Professor of Epidemiology, London School of Hygiene and Tropical Medicine, and then returned to Australia with an NHMRC Burnet Award. Since 1993 he has coordinated the assessment of health risks for the UN's Intergovernmental Panel on Climate Change. He edited the World Health Organisation/United Nations book: *Climate Change and Human Health: Risks and Responses* (2003), and currently chairs the international estimation of global disease burden due to climate change.

Dr Graeme Pearman
Monash University

Graeme Pearman was Chief of CSIRO Atmospheric Research, 1992–2002. He published over 150 scientific papers and now consults to both private and public sector organisations. He was elected to Fellowship of the Australian Academy of Science (1988), the Royal Society of Victoria (1997) and the Australian Academy of Technological Sciences and Engineering (2005). He was awarded the CSIRO Medal (1988), a United Nation's Environment Program Global 500 Award (1989), Australian Medal of the Order of Australia (1999) and a Federation Medal (2003). He was science adviser to the Hon Al Gore during his visits to Australia in 2006 and 2007. During 2007 he made over 120 briefings on climate-change science to companies, governments, peak industry bodies and public fora and was science adviser to the ABC TV program *Carbon Cops*.

Tony Coleman
Chief Risk Officer & Group Actuary – Insurance Australia Group

Tony Coleman has extensive experience in the insurance, investment and finance sectors. He is responsible for IAG's risk management function which includes product pricing policy, claims liability reserving, research and development, capital allocation, operational risk monitoring, and group compliance. Prior to joining IAG in December 2000, he was a senior corporate finance partner of PricewaterhouseCoopers. Tony is a former President of the Institute of Actuaries of Australia (IAAust) and was named Actuary of the Year by IAAust in 2004. Internationally, he is an active representative of IAAust in various activities of the International Actuarial Association and a Director of the Enterprise Risk Management International Institute. He is also the only Australian member of the International Accounting Standards Board Insurance Working Group which is advising the IASB on the development of International Accounting Standards for insurance.

Greg Bourne
CEO WWF-Australia

Greg Bourne has been the CEO of WWF-Australia since 2004. He is also a Member of the CSIRO Sector Advisory Council to the Natural Resource Management and Environment Sector, a member of the National Environmental Education Council, and a member of the Advisory Council for the CSIRO Energy Transformed Flagship. He was awarded the Centenary Medal for services to the environment and has received an Honorary Doctorate from the University of Western Australia for services to international business.

Prior to joining WWF-Australia Greg had a long career with BP PLC, having held a number of senior roles including Regional President of BP Australasia from 1999 to 2003. Greg has also acted as Special Adviser on Energy and Transport to the Prime Minister of the United Kingdom.

REFERENCES

Bruno, J. F., and Selig E. R., *Regional Decline of Coral Cover in the Indo-Pacific: timing, extent, and subregional comparisons*, 2007

Carbon Equity, *The big melt: lessons from the Arctic Summer of 2007*, October 2007

Carter, R., *CSIRO Submission to the Prime Minister's Task Group on Emissions Trading*, March 2007

CSIRO and Australian Bureau of Meteorology, *Climate Change in Australia: technical report 2007*

Hansen, J., et al., (2007) *Dangerous human-made interference with climate: a GISS modelE study in* Atmospheric Chemistry and Physics 7: 2287–2312

Hoegh-Guldberg, O., Mumby, P. J., Hooten, A. J., Steneck, R. S., Greenfield, P., Gomez, E., Harvell D. R., Sale, P. F., Edwards, A. J., Caldeira, K., Knowlton, N., Eakin, C. M., Iglesias-Prieto, R., Muthiga, N., Bradbury, R. H., Dubi, A., and Hatziolos, M. E., (2007) *Coral Reefs Under Rapid Climate Change and Ocean Acidification in Science,* vol 318: 1737–1742

Hodges, H., *Falling Prices: Cost of Complying With Environmental Regulations Almost Always Less Than Advertised*, Economic Policy Institute Briefing Paper, November 1997

Intergovernmental Panel on Climate Change (Intergovernmental Panel on Climate Change), *Fourth Assessment Report*, 2007

Leslie, L.M, Leplastrier, M., Buckley, B., (2007) *Estimating future trends in severe hailstorms over the Sydney Basin: A climate modelling study,* Atmospheric Research 87 No 1: 37-51

Leslie, L. M., Karoly, D. J., Leplastrier, M., and Buckley, B. W., (2007) *Variability of tropical cyclones over the southwest Pacific Ocean using a high-resolution climate model in Meteorology* Atmospheric Physics 97: 171–180

NSW Government, *NSW Greenhouse Plan*, November 2005

Pittock, B., (2006) *Are Scientists Underestimating Climate Change?* in Ecos vol 87 No 34: 340

Raupach, M. R., et. al., *Global and Regional Drivers of Accelerating CO_2 Emissions*, Proceedings of the National Academy of Sciences of the United States of America, 2007 http://www.ornl.gov/info/ornlreview/v40_3_07/documents/article17web_raupach_etal_2007PNAS.pdf (accessed 13 December 2007)

Raven, J., Caldeira, K., Elderfield, H., Hoegh-Guldberg, O., Liss, P., Riebesell, U., Shepherd, J., Turley, C., Watson, A., *Ocean acidification due to increasing atmospheric carbon dioxide*, Royal Society Special Report, 2005

Riebesell, U., Shepherd, J., Turley, C., Watson, A., *Ocean acidification due to increasing atmospheric carbon dioxide*, Royal Society Special Report, 2005

Tourism Celebrates Success of Great Barrier Reef Protection Plan, 21 August 2006 http://www.qtic.com.au/index.php?option=com_content&task=view&id=292&Itemid=95 (accessed 10 September 2007)

World Wide Fund for Nature – Australia, *A prosperous low carbon future*, 2006

	2030	2035	2040	2045	2050